PRACTITIONER'S DOCKET NO.: FRANKS-086

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:	MOSING, DONALD E.	§	
APPLICATION NO.:	10/027,502	§	GROUP NO.: 3679
FILED:	NOVEMBER 27, 2001	§	EXAMINER: DANIEL P. STODOLA
		§	
FOR:	SLIP GROOVE GRIPPING DIE	§	

SECOND AMDENDED BRIEF TO BOARD OF PATENT APPEALS AND INTERFERENCES

UNDER 37 CFR 41.37

HON. COMMISSIONER OF PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

Dear Sir:

REMARKS

Responsive to the Office Communication dated November 7, 2007, please enter the enclosed, revised Appeal Brief.

The only changes in this Brief relate to a revision of Article 5, which has been amended to more fully comply with the requirements of 37 CFR 41.37(c)(1)(v).

The entire Brief, however, is resubmitted herewith, based upon the Examiner's statement that the EVIDENCE APPENDIX (Article 9) was incomplete when originally submitted. Complete Copies of the U.S. Patent Nos. 4,678,209 and 5,971,086, as well as the blown-up drawings of FIG.'s 3 and 4 of U.S. Patent No. 4,678,209 are also enclosed.

With all due respect, there would appear to be no reason for the Examiner to object to Exhibit C. FIG.'s 3 and 4 of Exhibit C are merely duplicates of FIG.'s 3 and 4 of U.S. Patent No. 4,678,209, with lines 100, 101, 102 and 103 added to show that the lines 100 and 101, as well as the lines 102 and 103 can not be parallel.

Respectfully submitted,

1/07/08
Date

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1. **Real Party In Interest**

The real party in interest is Frank's Casing Crew and Rental Tools, Inc.

2. **Related Appeals and late references**

None

3. **Status of Claims**

The following set of claims 1-10, 12-16, 19 and 20, were all finally rejected and are currently on appeal.

Claims 1-10, 12-16, 19, and 20 are rejected.

Claims 11 and 17-18 have been cancelled.

4. **Status of Amendments**

All amendments to the claims have already been entered by the Examiner. No amendments are currently pending.

5. **Summary of Claimed Subject Matter of Independent Claims 1, 5, 12, 19 and 20.**

CLAIM 1

1. A die insert for use in die insert confining grooves in slips for use in pipe string handling apparatus, the die insert comprising:

a) a front face with pipe gripping teeth and a back face being generally parallel to said front face; and

b) said back face including textured relief for engaging the slip.

Analysis under 37 CFR 41.37 (c)(1)(v)

Claim 1 calls for a die insert for a slip having a front face and a back face and for the two faces to be generally parallel, and for the back to be textured, or to have surface depressions. The die insert for Claim 1 is identified with the numeral 1 in FIG. 1 and by the numeral 4 in FIG.'s 5, 6, 7 and 8, is described in the specification on page 7, lines 1-15. The die insert 1 illustrated in FIG. 1 resides in a slip (labeled as "SLIP" in FIG. 1), also described on page 7, lines 1-15 of the specification. The die insert 1, illustrated in FIG. 1 has a front face 2 and a back face 3. The front face 2 has teeth (unnumbered) for engaging a pipe and the back surface 3 is roughed up or textured to prevent or lessen movement between the die insert 1 and the slip, as described on page 7, lines 8-10 of the specification. The faces 2 and 3 are parallel to each other, as presented in claim 1 as originally filed in this application. Claim 1 does not call for means plus function or step plus function as contemplated by 35 USC 112, sixth paragraph.

CLAIM 5

5. A die insert for use in a pipe string handling apparatus having first and second faces, said first and second faces being generally parallel to each other, said die insert comprising;

a) said first faces textured with projecting teeth for gripping pipe surfaces; and

b) the second face textured with surface depressions forming indicia to reduce the surface area in contact with a mating surface of die insert carrying slips such that more than a selected normal loading of the die insert will coin an impression of the indicia of the textured surface of the die insert into the mating surface of the related die insert carrying slip, for the purpose of reducing the tendency of the die insert to slide [[in]] on the slip when the die insert is carrying a substantial payload.

Analysis under 37 CFR 41.37 (c)(1)(v)

Claim 5 calls for a die insert for a slip having a front face and a back face and for the two faces to be generally parallel, and for the back to be textured, or to have surface depressions. The die insert for Claim 5 is identified with the numeral 1 in FIG. 1 and by the numeral 4 in FIG.'s 5, 6, 7 and 8, is described in the specification on page 7, lines 1-15. The die insert 1 illustrated in FIG. 1 resides in a slip (labeled as "SLIP" in FIG. 1), also described

on page 7, lines 1-15 of the specification. The die insert 1, illustrated in FIG. 1 has a front face 2 and a back face 3. The front face 2 has teeth (unnumbered) for engaging a pipe and the back surface 3 is roughed up or textured to prevent or lessen movement between the die insert 1 and the slip, as described on page 7, lines 8-10 of the specification. The faces 2 and 3 are parallel to each other, as presented in Claim 5 as originally filed in this application. Claim 5 does not call for means plus function or step plus function as contemplated by 35 USC 112, sixth paragraph.

CLAIM 12

12. A die insert for use in a pipe handling apparatus, having first and second faces, said first and second being generally parallel with respect of each other, said die insert comprising;

a) said first face textured with projecting teeth for gripping pipe surfaces; and

b) the second face textured with surface depressions created to displace metal upward in the vicinity of the depression to present a small elevated surface accumulation of such limited effective collective load bearing area that the raised metal will be imbedded into a surface of insert supporting surfaces of a die carrying slip, when subjected to a preselected amount of force substantially perpendicular to said second face, to reduce the tendency for the insert to slide on the insert support surfaces and create indicia on the insert support surfaces.

Analysis under 37 CFR 41.37 (c)(1)(v)

Claim 12 calls for a die insert for a slip having a first face and a second face and for the two faces to be generally parallel, and for the back to be textured, or to have surface depressions. The die insert for Claim 12 is identified with the numeral 1 in FIG. 1 and by the numeral 4 in FIG.'s 5, 6, 7 and 8, is described in the specification on page 7, lines 1-15. The die insert 1 illustrated in FIG. 1 resides in a slip (labeled as "SLIP" in FIG. 1), also described on page 7, lines 1-15 of the specification. The die insert 1, illustrated in FIG. 1 has a first face 2 and a second face 3. The first face 2 has teeth (unnumbered) for engaging a pipe and the back surface 3 is textured with surface depressions to displace metal upward, to present a small upward surface, such that the raised metal will be imbedded into the slip itself, described on page 4 of the specification, lines 20-25, on page 5, lines 16-21, and with respect to FIG. 4, lines 8 and 9, describing the surface 3, the groove 3a and the metal 3b, thereby to prevent or lessen movement between the die insert 1 and the slip, as described on page 7,

lines 8-10 of the specification. Claim 12 does not call for means plus function or step plus function as contemplated by 35 USC 112, sixth paragraph.

CLAIM 19

19. A die insert for use in a slip for use in a pipe handling apparatus, the die insert comprising:

a front face with a pipe gripping surface;

a back face, said back face is being generally parallel to said front face, wherein said back face contacts said slip; and

substantially uniform textured relief formed on a surface of the back face for forming and engaging impressions in the opposing surface of the slip when forced against the opposing surface to add skid resistance between the die insert and the opposing surface.

Analysis under 37 CFR 41.37 (c)(1)(v)

Claim 19 calls for a die insert for a slip having a front face and a back face and for the two faces to be generally parallel, and for the back to be textured. The die insert for Claim 19 is identified with the numeral 1 in FIG. 1 and by the numeral 4 in FIG.'s 5, 6, 7 and 8, is described in the specification on page 7, lines 1-15. The die insert 1 illustrated in FIG. 1 resides in a slip (labeled as "SLIP" in FIG. 1), also described on page 7, lines 1-15 of the specification. The die insert 1, illustrated in FIG. 1 has a front face 2 and a back face 3. The front face 2 has teeth (unnumbered) for engaging a pipe and the back surface 3 is textured to prevent or lessen movement between the die insert 1 and the slip, as described on page 7, lines 8-10 of the specification. The faces 2 and 3 are parallel to each other, as originally filed in this application. Claim 19 calls for textured relief on the back face for forming and engaging impressions in the surface on the slip, described, with respect to FIG. 1, on page 7, lines 7-10 of the specification. Claim 19 does not call for means plus function or step plus function as contemplated by 35 USC 112, sixth paragraph.

CLAIM 20

20. A die insert for use in a pipe sting handling apparatus having first and second faces, said first and second faces being generally parallel to each other, said die insert comprising;

said first face being textured with projecting teeth for gripping pipe surfaces;

said second face having a surface area, wherein said surface area at least partially contacts a mating surface of a slip; and

the second face textured with surface depressions to reduce the surface area in contact with said mating surface of a slip such that the loading of the die insert will coin an impression of the textured surface of the die insert into the mating surface of the related slip, for the purposed of transferring the loading from the die insert to the slip.

Analysis under 37 CFR 41.37 (c)(1)(v)

Claim 20 calls for a die insert for a slip having a front face and a back face and for the two faces to be generally parallel, and for the back to be textured, or to have surface depressions. The die insert for Claim 20 is identified with the numeral 1 in FIG. 1 and by the numeral 4 in FIG.'s 5, 6, 7 and 8, is described in the specification on page 7, lines 1-15. The die insert 1 illustrated in FIG. 1 resides in a slip (labeled as "SLIP" in FIG. 1), also described on page 7, lines 1-15 of the specification. The die insert 1, illustrated in FIG. 1 has a front face 2 and a back face 3. The front face 2 has teeth (unnumbered) for engaging a pipe and the back surface 3 is textured to prevent or lessen movement between the die insert 1 and the slip, as described on page 7, lines 8-10 of the specification. The faces 2 and 3 are parallel to each other, as originally filed in this application. Claim 20 also calls for the texture pattern of lands 6d on the back surface 3 of the slip 1 to be coined into the surface of the slip 1, itself, all as described with respect to FIG.'s 7 and 8, on page 9, lines 1-8 of the specification. Claim 20 does not call for means plus function or step plus function as contemplated by 35 USC 112, sixth paragraph.

6. **Grounds of Rejection To Be Reviewed On Appeal**

a) Claims 1, 3-5, 8-10, 12, 15-16, 19 and 20, have been rejected under 35 USC 102 (b) as being anticipated by U.S. Patent No. 4,678,209 to Guice (the `209 patent). Please see Exhibit A.

b) Claims 2, 6, 7, 13 and 14 have been rejected under 35 USC 103 (a) as being unpatentable over U.S. Patent No. 4,678,209 to Guice (the `209 patent) in view of U.S. Patent No. 5,971,086 to Bee, et al (the `086 patent). Please see Exhibit B.

7. **Argument**

Claim Rejections – 35USC § 102

A favorable consideration is respectfully requested for Claims 1, 3-5, 8-10, 12, 15, 16, 19, and 20, said claims having been rejected under 35 USC 102(b) as being anticipated by U.S. Patent No. 4,678,209 to Guice. These rejections are respectfully traversed.

Applicant's die inserts and slips are used to grip pipe for such operations as, but not limited to, drilling, running and tripping tubulars, making up and breaking out tubulars, and handling tubulars around the rig area. Die inserts are used because they are less expensive to change out and a particular set of slips can be used for various size tubulars by just changing the die inserts. Traditionally die inserts had a smooth back face which contacted the smooth face of the slip. These die inserts were bolted to the slips or were inserted in a groove or otherwise confined or attached to the slip or die inserts. The Applicant has discovered that, by adding some type of texture or depression to the back face of the die insert, the die insert will transfer load more uniformly across the surface of the die insert contacting the slip. In turn, the load on the slips is distributed more evenly; thus, substantially lowering the possibility that any parts of the die inserts, slips, or pipe handling equipment will fail due to entire loads being supported at just a few points.

Applicant respectfully submits that the Guice `209 reference is non-analogous art. The applicant claims a die insert for slips in a pipe handling apparatus. The Guice reference, being directed to a casing hanger, does not even disclose or suggest using die inserts. The die inserts in the current application are used to grip the pipe, whereas the slips themselves, not the dies, in the Guice reference are used to grip the pipe. The purpose of using these die inserts is to make sure that the pipe is gripped in such a way that no portion of the slip contacts the pipe before another portion of the slip. Another purpose of the die insert is to be replaceable in case some of the teeth break off. For example, if the teeth, 32, in the Guice '209 patent are broken off, the entire slip has to be replaced. By using a plurality of die inserts, a die insert can be damaged and replaced by another die insert for much less time and expense. For this technology to work properly, the die inserts must all contact the pipe at the same time. In sharp contrast from the present application, the Guice reference discloses a slip without the use of die inserts. Instead, the Guice reference discloses a slip in which one face of the slip is vertical , to ensure that most or all of the teeth are in contact with the tubular

(see Guice, Column 4, Lines 19-21), and the other face of the slip is tapered to slide down the tapered slip bowl while the vertical face continues its vertical orientation (see FIG. 5). The face gripping the pipe will generally remain vertical to grip all portions of the pipe at the same time. Because the back face of the slip must be tapered, it cannot be parallel to the front face of the slip.

Additionally, the Examiner argues that the faces of Guice ('209) are generally parallel as evidenced by the illustration in Fig. 2. With all due respect, the Examiner erroneously interpreted Fig. 2 of the Guice reference. Although the faces appear to be parallel in the view of Fig. 2, it cannot be determined from that top view whether the faces are parallel (meaning extending in the same direction and never converging or diverging). Only the top edges of the faces can be seen in Fig. 2 and therefore it cannot be determined whether they are parallel. If fact, they are not parallel. This can be seen in Figs. 3, 4 and 5 of the Guice reference. These figures show the length of the front and back faces and show that the faces are, in fact, not parallel (extending in the same direction and never converging or diverging). Included as Exhibit C are blown up versions of Guice's FIG. 3 and FIG. 4. We have extended the faces in both FIG. 3 and FIG. 4 (see Exhibit C, 100, 101, 102, 103, and 104) so the Board can clearly see that the lines converge. Since the lines extended from the faces converge, the faces are not parallel.

Additionally, the invention, as disclosed in the Guice reference, would not function properly if the faces were parallel because, as can be seen in FIG. 1 of the Guice reference, the slip 20 must grip the pipe in a "face-to-face engaging relationship." Guice, Column 4, lines 19-21. In order to accomplish the slip engaging the pipe face-to-face and also sliding up and down the tapered bowl (FIG.1), the faces cannot be parallel (See FIG. 5).

In sharp contrast, each and every claim of the current application requires that the front and back faces of the die inserts be substantially **parallel**. Therefore, it is respectfully submitted that Claims 1, 3-5, 8-10, 12, 15, and 16 are patentable over the cited Guice reference and that the rejection should be withdrawn.

Claim Rejections-35 USC § 103

Reconsideration is respectfully requested for Claims 2, 6, 7, 13, and 14, said claims having been rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No.

4,678,209 to Guice in view of U.S. Patent No. 5,971,086 to Bee et al. Applicant respectfully traverses this rejection. The reference to Bee et al does not add anything to the Guice reference to support a rejection. Bee simply discloses adding a coating to the teeth 11, which are on the front face of the slip. There is nothing in the Bee reference which discloses roughing the back face of the die. Claims 2, 6, 7, 13, and 14 are thereby submitted to be patentable for the reasons set forth above.

8. **Claims Appendix**

See attached Claims Appendix.

9. **Evidence Appendix**

See attached Evidence Appendix.

10. **Related Proceedings Appendix**

None

SUMMARY

The cited art does not disclose, teach or even suggest a die insert having parallel first and second faces, wherein the first face has teeth for gripping pipe surfaces and the second face has a surface which is textured, or which contains depressions to add skid resistance between the second face of the die insert and the slip, as called for in each of Claims 1-10, 13-16, 19 and 20.

It is therefore respectfully submitted that Claims 1-10, 12-16, 19 and 20 are patentably distinct over the art of record. The Applicant courteously solicits the allowance of Claims 1-10, 12-16, 19 and 20.

Respectfully submitted,

1/07/08
Date

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8. CLAIMS APPENDIX
CLAIMS 1-10,12-16, 19 AND 20 ALL REJECTED AND CURRENTLY ON APPEAL

SECOND AMENDED APPEAL BRIEF TO BOARD OF PATENT APPEALS AND INTERFERENCES UNDER 37 CFR 41.37

CURRENT STATUS OF CLAIMS

Please find the current status of the claims, as of the filing of this amendment paper, as follows:

1. (Rejected) A die insert for slips for use in a pipe handling apparatus, the die insert comprising:

a) a front face with pipe gripping teeth and a back face being generally parallel to said front face; and

b) said back face including textured relief for engaging the slip.

2. (Rejected) The die insert according to Claim 1 wherein said textured relief comprises a plurality of generally transverse relief patterns, the relief representing surface depressions of more than one one-thousandth inch.

3. (Rejected) The die insert according to Claim 1 wherein said texture relief is achieved by a plurality of generally transverse scribe lines.

4. (Rejected) The die insert according to Claim 1 wherein said texture relief is achieved by acid etching of the surface of the back face.

5. (Rejected) A die insert for use in a pipe handling apparatus having first and second faces, said first and second faces being generally parallel to each other, said die insert comprising;

a) said first faces textured with projecting teeth for gripping pipe surfaces; and

b) the second face textured with surface depressions forming indicia to reduce the surface area in contact with a mating surface of die insert carrying slips such that more than a selected normal loading of the die insert will coin an impression of the indicia of the textured surface of the die insert into the mating surface of the related die insert carrying slip, for the purpose of reducing the tendency of the die insert to slide ~~in~~ on the slip when the die insert is carrying a substantial payload.

6. (Rejected) The die insert according to Claim 5 wherein said textured surface depressions are more than one one-thousandth of an inch deep.

7. (Rejected) The die insert according to Claim 5 wherein said textured surface depressions comprise a plurality of generally transverse relief patterns, the relief representing a surface depression of more than one thousandth inch.

8. (Rejected) The die insert according to Claim 5 wherein said textured surface depressions are achieved by a plurality of generally transverse scribe lines.

9. (Rejected) The die insert according to Claim 5 wherein said textured surface depressions are achieved by acid etching of the insert.

10. (Rejected) The die insert according to claim 5 wherein said textured surface on said second face forming indicia comprises a logo or drawing.

11. Canceled

12. (Rejected) A die insert for use in a pipe handling apparatus, having first and second faces, said first and second faces being generally parallel with respect of each other, said die insert comprising;

a) said first faces textured with projecting teeth for gripping pipe surfaces; and

b) the second face textured with surface depressions created to displace metal upward in the vicinity of the depression to present a small elevated surface accumulation of such limited effective collective load bearing area that the raised metal will be imbedded into a surface of insert supporting surfaces of a die carrying slip, when subjected to a preselected amount of force substantially perpendicular to said second face, to reduce the tendency for the insert to slide on the insert support surfaces and create indicia on the insert support surfaces.

13. (Rejected) The die insert according to Claim 12 wherein said textured surface depressions are more than one one-thousandth of an inch deep.

14. (Rejected) The die insert according to Claim 12 wherein said textured surface depressions comprise a plurality of generally transverse relief patterns, the relief representing a surface depression of more than one thousandths inch.

15. (Rejected) The die insert according to Claim 12 wherein said textured surface depressions are achieved by a plurality of generally transverse scribe lines.

16. (Rejected) The die insert according to Claim 12 wherein said textured surface depressions are achieved by acid etching of the insert.

17-18. Canceled.

19. (Rejected) A die insert for use in a slip for use in a pipe handling apparatus, the die insert comprising:

a front face with a pipe gripping surface;

a back face, said back face being generally parallel to said front face, wherein said back face contacts said slip; and

substantially uniform textured relief formed on a surface of the back face for forming and engaging impressions in the opposing surface of the slip when forced against the opposing surface to add skid resistance between the die insert and the opposing surface.

20. (Rejected) A die insert for use in a pipe sting handling apparatus having first and second faces, said first and second faces being generally parallel to each other, said die insert comprising;

said first face being textured with projecting teeth for gripping pipe surfaces;

said second face having a surface area, wherein said surface area at least partially contacts a mating surface of a slip; and

the second face textured with surface depressions to reduce the surface area in contact with said mating surface of a slip such that the loading of the die insert will coin an impression of the of the textured surface of the die insert into the mating surface of the related slip, for the purpose of transferring the loading from the die insert to the slip.

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9. EVIDENCE APPENDIX

SECOND AMENDED APPEAL BRIEF TO BOARD OF PATENT APPEALS AND INTERFERENCES UNDER 37 CFR 41.37

A. US Patent No. 4,678,209 to Guice.
B. US Patent No. 5,971,086 to Bee, et al.
C. Blown-Up FIG.'s 3 and 4 of Ex. A.

United States Patent [19]

Guice

[11] **Patent Number: 4,678,209**

[45] **Date of Patent: Jul. 7, 1987**

[54] **CASING HANGER**

[75] Inventor: **Walter L. Guice, Houston, Tex.**

[73] Assignee: **Vetco Offshore, Inc., Ventura, Calif.**

[21] Appl. No.: **789,681**

[22] Filed: **Oct. 21, 1985**

[51] **Int. Cl.**[4] **F16L 21/00**

[52] **U.S. Cl.** ..... **285/144; 285/146; 285/178; 285/350; 285/147; 277/188 R; 175/423**

[58] **Field of Search** ..... 285/144, 145, 146, 147, 285/148, 178, 348, 419, 350, 391; 188/67; 175/422 WS; 166/85; 277/188 R, 188 A, 165

[56] **References Cited**

U.S. PATENT DOCUMENTS

1,455,731	5/1923	Kelly	285/146
2,683,045	7/1954	Brooks	285/146
2,683,046	7/1954	Allen	285/146
3,051,513	8/1962	Watts et al.	285/147
3,096,554	7/1963	Johnson	285/147
3,257,130	6/1966	Watts et al.	285/147
3,367,002	2/1968	Johnson	285/144
3,994,517	11/1976	Carmichael	285/147
4,109,942	8/1978	Morrill	285/348
4,402,535	9/1983	Bridges	285/145

Primary Examiner—Cornelius J. Husar

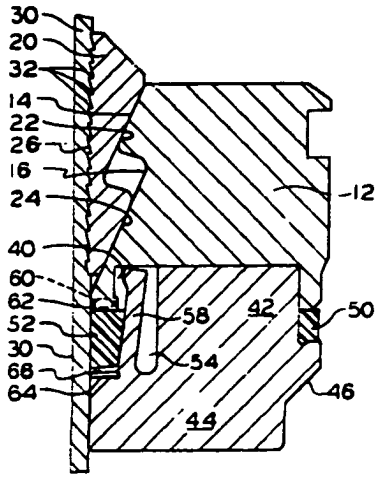
Assistant Examiner—Eric K. Nicholson

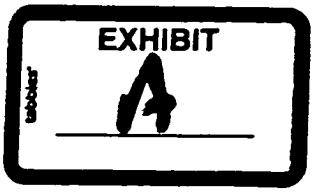
Attorney, Agent, or Firm—Chilton, Alix & Van Kirk

[57] **ABSTRACT**

An improved casing hanger for suspending a pipe string from a casing head at a well head employs a plurality of slip members having a series of teeth which are adapted for frictionally engaging the wedging surface of a slip bowl. The teeth have a profile which gradually tapers in accordance with the distance from a central portion of the slip member. The slip member is deformable from a first configuration wherein the edges of one surface of the slip member engage the pipe string while the central portion of the surface is spaced from the pipe string and the opposite surface of the slip member has a central portion which engages the slip bowl with the ends of the outer surface being spaced therefrom to a loaded configuration wherein the surfaces of the slip member engage the pipe string and the slip bowl along a series of substantially continuous arcuate paths. A deformable wall structure is also disposed adjacent the sealing element so that in the event that the compressive force exerted by the seal element exceeds a pre-established threshold value. The wall deforms to relieve the compressive force exerted by the sealing element.

12 Claims, 7 Drawing Figures





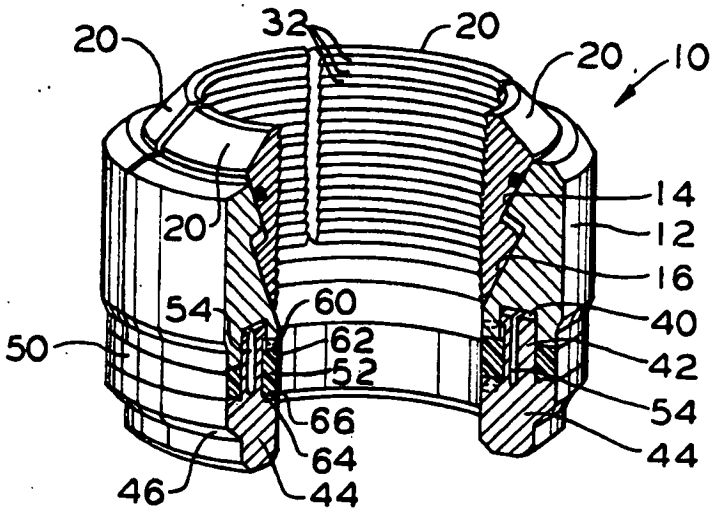

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FIG. 1

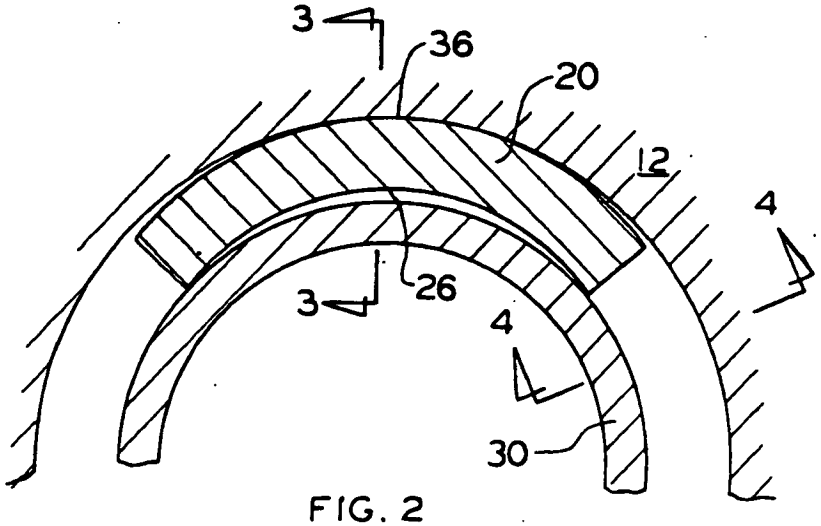
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FIG. 2

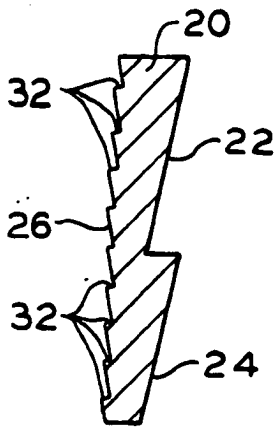

FIG. 3

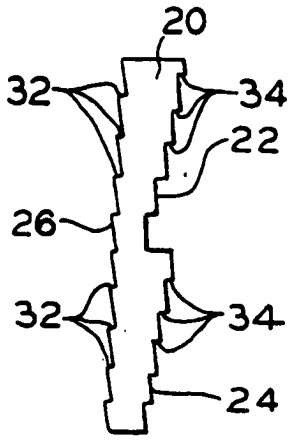

FIG. 4

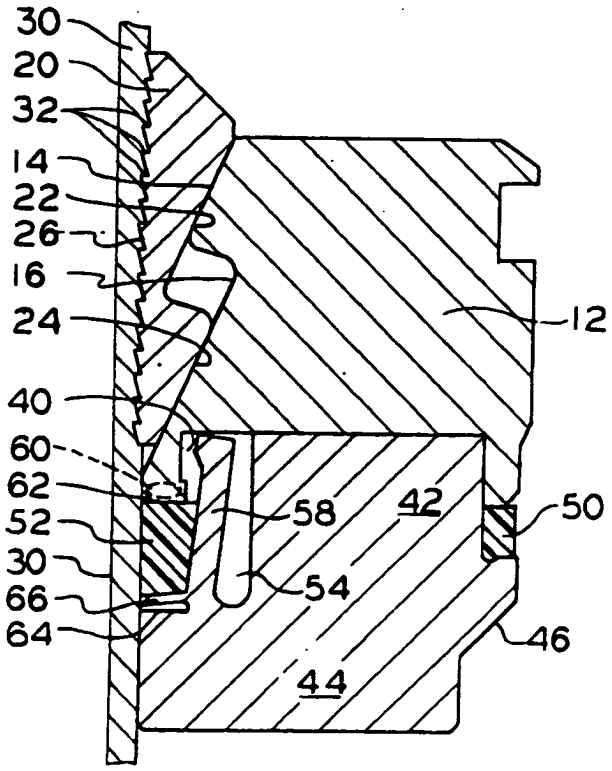

FIG. 5

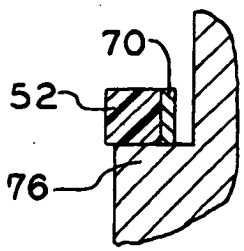

FIG. 6

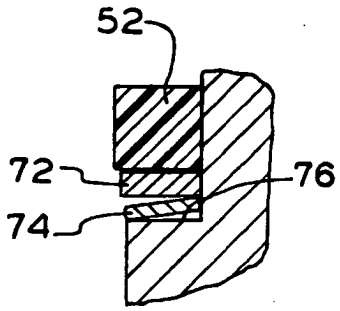

FIG. 7

CASING HANGER

BACKGROUND OF THE INVENTION

(1) Technical Field of the Invention

This invention relates generally to the suspension of conduits and particularly to the hanging of "strings" of piping. More specifically, the present invention relates to a casing hanger employed for suspending and externally sealing a pipe casing in a well-head. Accordingly, the general objects of the present invention are to provide novel and improved methods and apparatus of such character.

Casing hangers employed for suspending and sealing a casing at a well head typically comprise a generally annular shaped slip bowl and a plurality of movable slip members. The slip members have inwardly projecting teeth which engage the pipe casing centrally received in the slip bowl as the slip members are forced downwardly in the slip bowl due to the load of the casing weight. An annular ring seal is disposed below the slip members between a lower peripheral shoulder of the slip bowl and a compression ring. The seal is automatically loaded against the casing as a result of the casing forcing the slips and slip bowl against the seal.

The suspension capacity of a casing hanger is ordinarily limited by a critical threshold which is related to the suspended casing weight. When this critical threshold is exceeded an excessive casing deflection or "bottle necking" phenomena develops at the slip members/casing interface due to the compressive load exerted on the casing by the slip members. As noted above, the applied load of the casing also causes compression of the seal carried by the hanger against the casing being suspended. When the seal is placed under excessive loads, the compressive forces exerted on the casing by the seal may actually deflect or crush the casing. Thus, the seal assembly of the typical casing hanger also provides a constraint on the weight which the slip members can carry before the system fails due to a reduction of the diameter of a casing. Further, the integrity of the seal established by the casing hanger can become problematic due to dimensional variations in the casing outside diameter and variations in the concentricity of the casing. The seal assembly is ordinarily configured so that, when the seal is fully loaded, the seal assembly seals against the smallest permissible casing diameter within the given size range for which the hanger assembly has been designed. However, when the same seal is also employed for sealing against the largest diameter casing which the hanger assembly can accommodate extremely high compressive stresses may be exerted against the casing by the seal assembly.

It is, accordingly, a principal aim of the present invention to provide a new and improved casing hanger and casing suspension method which control the compressive load placed on a suspended casing by the casing engaging slip members and which also provide a sealing means for accommodating variations in casing diameter and concentricity without exerting an excessive load against the casing.

(2) Prior Art

U.S. Pat. No. 2,824,757 discloses a pipe suspension and sealing system which includes means to limit compression of the seal of a casing hanger. The hanger automatically seals with the well head in which the hanger is seated when pipe weight is applied to the hanger. A load limiting structure is incorporated into the pipe suspension assembly so that only a portion of the casing weight transferred by the slips is applied to the material which forms the seal to prevent the seal material from being placed under excess compression.

Another commercially available casing hanger employs slip members which are precision machined with sharp inner teeth. The teeth are adapted to provide a positive bite to hold the casing securely. In addition, dull outer teeth are precision machined at the back of the slip members and extend uniformly from side to side in parallel fashion for contacting the slip bowl to automatically control the slip member/slip bowl friction so that the friction increases as the casing load increases and the downward slip member travel ceases before damage to the casing can occur.

BRIEF SUMMARY OF THE INVENTION

Briefly stated, the invention in a preferred form is an improved casing hanger for suspending a pipe string or the like. The casing hanger of the invention comprises a slip bowl adapted for seating in a casing hanger. A plurality of slip members are disposed in circumferential spaced relationship in the slip bowl and define a central pipe casing receiving bore. The slip members are adapted for wedging movement downwardly and inwardly for engagement with the exterior of a pipe string disposed in the bore to support the pipe string therein. The slip members have an inner surface with a first series of teeth adapted for engagement with a received pipe string and also have opposing outer surfaces with a second series of teeth adapted for engagement with wedging surfaces in the slip bowl. The second series of teeth has a tapered tooth profile wherein the teeth protrude at an increasing radial distance from said slip member outer surfaces in accordance with the circumferential distance from the center portion of the slip members. The slip members have a bowed configuration when the casing hanger is unloaded so that initially the side edges of the inner surface enage an inserted pipe string while the central portion thereof is spaced from the pipe string. Also, in this bowed configuration, a central portion of the outer surfaces of each slip member engages a slip bowl wedging surface while the side edge portions of the outer surfaces are spaced from the slip bowl. During loading the slip members deform to engage the pipe string and the slip bowl along a series of continuous arcuate paths at the inner and outer surface of the slip members.

In the preferred embodiment of the invention a compression ring is coupled to the slip bowl and is capable of limited movement relative thereto. The compression ring cooperates with the slip bowl to define two pairs of facing shoulders. A sealing element is disposed between the shoulders of each pair. One of these sealing elements is adapted for radially sealingly enaging the pipe string. Upon application of a compressive load against the shoulders a deformable wall adjacent the sealing elements deforms to relieve the compressive force exerted by the sealing element when the compressive force exceeds a pre-established threshold level. The deformable wall may extend from the compression ring and have a generally annular shape disposed co-axial with the axis of the casing hanger bore. The deformable wall may also be partially defined by a sealing element engaging shoulder of the compression ring or a sealing element engaging shoulder of the slip bowl.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary side perspective view of a casing hanger in accordance with the present invention;

FIG. 2 is a fragmentary top sectional view of the casing hanger of FIG. 1;

FIG. 3 is a side sectional view of a slip member of the casing hanger of FIG. 2 taken along the line 3—3 thereof;

FIG. 4 is a end view of a slip member of FIG. 2 taken along the line 4—4 thereof;

FIG. 5 is an enlarged fragmentary sectional view illustrating a casing suspended by the hanger of FIG. 1;

FIG. 6 is an enlarged fragmentary sectional view illustrating an alternate seal configuration for a casing hanger in accordance with the present invention; and

FIG. 7 is an enlarged fragmentary sectional view illustrating yet another seal configuration embodiment for a casing hanger in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the drawing, wherein like numerals represent like parts throughout the several FIGURES, a casing hanger in accordance with the present invention is generally designated by the numeral 10. Casing hanger 10 is exteriorly configured so that the hanger may be landed in a casing head (not illustrated) for suspending a pipe string (not illustrated) at a well head.

Casing hanger 10 includes a slip bowl 12 formed by two semi-cylindrical members. The slip bowl defining members are exteriorly dimensioned and configured for close receptive accommodation within the upper bore of a well casing head for seating therein. The interior surface of slip bowl 12 forms a pair of vertically spaced downwardly and inwardly inclined frustoconical wedging surfaces 14 and 16.

A plurality (commonly four or six) of segmental slip members 20 are received in slip bowl 12. The slip members 20 each have a pair of outer vertically spaced, quasi-frustoconical wedging surfaces 22 and 24 which are respectively generally complementary in shape to and engageable with surfaces 14 and 16 of the slip bowl 12. With reference to FIGS. 2 through 4, each slip member also has an inner quasi-cylindrical surface 26. In the unloaded state the inner quasi-cylindrical surface 26 is bowed so that only the opposite vertical edges thereof contact the cylindrical casing 30 of the pipe string while the central portion of the inner surface of the slip member is spaced from the exterior surface of the casing. In opposite fashion, the center region of the outer surfaces 22, 24 of the slip member contact and slip bowl along a substantially linear vertical path while the side edges of the outer surfaces are spaced from the cooperating inner surfaces 22 and 24 of the slip bowl.

A series of teeth 32 are formed at the inner surface 26 of each the slip members to define a serrated surface. Teeth 32 extend between opposing sides of the slip member to form a vertical series of parallel teeth having an arcuate profile. The teeth 32 have relatively sharp edges which are adapted for forceably engaging the exterior of the casing 30 to thereby frictionally engage and suspend the casing. Each of the teeth 32 has a substantially uniform section throughout its arcuate extent.

A second series of substantially parallel teeth 34 are formed in the outer exterior surfaces 22 and 24 of slip members 20. Teeth 34 are configured so that the tooth profile gradually varies radially in symmetric fashion from substantially zero depth at the center 36 of the slip member outer surface, as illustrated in FIG. 3, to a well defined protruding tooth profile at each side edge of the slip member as best illustrated in FIG. 4. The foregoing tooth profile may be obtained by moving a slip member 20 off-center and machining a cut in the rear face of the member so that the cut is tangential to the rear face in the direction that the center has been displaced. The foregoing is accomplished by electronically controlled precision machining which results in the slip members having the full depth cut at the outer ends and the zero depth profile at the center as illustrated by the contrasting sections of FIGS. 3 and 4.

As the slip members are forced downwardly in the slip bowl 12 by the weight of a casing 30 received therein, each of the slip members flattens or deforms from the bowed configuration of FIG. 2 so that the center portions of the slip members are eventually brought into face-to-face engaging relationship with the casing. It should be appreciated that initially only the outer portions of the teeth 32 engage the casing and as the loading increases eventually virtually the entire arcuate extent of each of the teeth will be forced into engaging continuous biting relationship with the casing. Because the central portion of the outer surface of the slip members has no or minimal radial tooth protrusion, initially the slip moves easily relative to the slip bowl until the weight of the casing and the flattening of the slip members result in the outer edge portions of the teeth 34 engaging or biting into the slip bowl. During the make-up phase, i.e., from the time the slip members first contact the casing until they are fully engaged, increasingly high frictional forces are required. High frictional forces are required because the vertical component of those forces in effect exert the radial forces which support the suspended casing. The higher a vertical force that may be developed for a given radial force, the higher the casing weight that can be supported without compressive failure. Thus, the foregoing slip member configuration provides a means for positively controlling the coefficient of friction between the slip members and slip bowl in the casing hanger so that greater casing weights may be suspended without excessive bottle necking or deflection of the casing in the slip area.

The lower portion of each of the slip bowl defining members includes a circumferentially extending arcuate slot 40. Slot 40 is adapted to receive arcuate tongues 42 extending upwardly from associated lower members 44 of a segmented compression ring. Ring defining members 44 preferably correspond in number to the number of members forming the slip bowl. The compression ring has a downwardly facing exterior frustoconical surface 46 for engaging the seat of the casing head (not illustrated). The tongue and groove connection between the slip bowl and compression ring permits a limited amount of relative vertical movement between these components. A pair of annular sealing elements 50 and 52 are interposed between shoulders at the lower end of the slip bowl and facing shoulders defined by the members 44.

In a preferred embodiment an annular axially extending slot 54 is formed in the tongues 42 of the compression ring defining members 44. The wall 58 between the seal element 52 and the slot 54 has a pre-established thickness and rigidity whereby the wall does not deform or deflect under the influence of a normal sealing

load when the weight of the casing forces the lower peripheral shoulder of the slip bowl toward the facing shoulder of the compression ring to compress the seal elements 50 and 52 respectively into radial engagement with the casing and the casing hanger.

With reference to FIG. 5, in the event that the compression of the seal elements exceeds a pre-established threshold level required for sealing, the wall 58 will be radially deflected or displaced into the slot 54 to accommodate the radially expanded seal element and thereby prevent crushing of the casing. Ordinarily, air at atmospheric pressure occupies the slot 54. It should be appreciated that the above-described wall/slot configuration relieves the very high compressive forces that would otherwise be introduced into the casing from the seal. In instances where relatively large diameter casings are employed the ring loading in the casing ordinarily adds directly to the loading caused by the slip members due to the proximity of the seal element to the lower end of the slips.

In an alternative embodiment, an annular slot 60 (illustrated in dashed lines) may be milled in addition or in the alternative to slot 54 to form a deformable wall 62. Slot 60 extends circumferentially around the slip bowl and is serially partially defined by shoulder the lower which engages the sealing element. In yet a third embodiment of the invention, an annular slot 64 may be milled into compression ring to form a deformable wall 66 adjacent the upper shoulder which contacts the sealing element. In each of the embodiments, the deformable walls are configured to deflect or deform into the adjacent slots to accommodate the compressed sealing element in the event that the force exerted by the seal against the casing becomes excessive.

With reference to FIG. 6, the seal element 52 is surrounded by a thin walled metallic cylinder 70. Cylinder 70 is a deformable member which is not integral with the rest of the slip bowl or compression ring and is dimensioned so that an annular expansion cavity accommodates the radial expansion of the cylinder. As the loading on the seal element 52 approaches the preestablished maximum seal pressure, the cylinder 70 expands radially into the cavity so that the seal engagement yields at the maximum seal pressure.

With reference to FIG. 7, the seal element 52 is mounted above a backup washer 72. A belleville spring 74 is positioned between backup washer 72 and shoulder 76 of the compression ring. The belleville spring 74 deforms to relieve the compressive force exerted by the sealing element when the compressive force exceed a preestablished threshold level.

While preferred embodiments of the foregoing invention have been set forth for purposes of illustration, the foregoing description should not be deemed a limitation of the invention herein. Accordingly, various modifications, adaptations and alternatives may occur to one skilled in the art without departing from the spirit and scope of the present invention.

I claim:

1. An improved casing hanger for suspending an inner pipe string or the like from an interior seat of a casing head comprising:

a slip bowl forming an exterior seat for engaging the interior seat of a casing head and forming an inner wedging surface defining a central opening therein;

slip means disposed in circumferentially spaced relation about said opening and forming a central bore for wedging movement downwardly and inwardly with respect to said wedging surface into engagement with the exterior of a pipe string disposed in said bore to support the pipe string therein, said slip means comprising a plurality of slip members having an inner surface with a series of teeth engageable into a pipe string disposed in said bore and having an opposing outer surface with a second series of teeth engageable with the slip bowl wedging surface, said second series of teeth having a tapered tooth profile wherein said teeth protrude at an increasing radial distance from said outer surface in accordance with the distance from a central outer surface portion of said slip member.

2. The casing hanger of claim 1 wherein the central outer portion of each said slip member forms a substantially smooth surface.

3. The casing hanger of claim 1 wherein slip members have inner and outer surfaces which extend between opposing ends to form edges with said surfaces, said slip members being bowed in a first configuration so that the edges of the inner surface engage a pipe string with the central portion thereof being spaced from said pipe string in non-engagement relationship and a central portion of the outer surface and said slip member engages said slip bowl wedging surface with the ends thereof being spaced from said slip bowl in non-engaged relation thereto.

4. The casing hanger of claim 3 wherein each said slip member deforms to engage said pipe string and said slip bowl along a series of continuous arcuate paths at the inner and outer surfaces of said slip members.

5. The casing hanger of claim 1 wherein slip members have inner and outer surfaces which extend between opposing ends to form edges with said surfaces, said slip members being bowed in a first configuration so that the edges of the inner surface engage a pipe string with the central portion thereof being spaced from said pipe string in non-engagement relationship and a central portionof the outer surface of said slip member engages said slip bowl wedging surface with the ends thereof being spaced from said slip bowl in non-engaged relation thereto.

6. The casing hanger of claim 5 wherein said deformable wall means comprises a wall which extends from said compression ring and has a generally annular shape disposed coaxially with the axis of the bore.

7. The casing hanger of claim 5 wherein said deformable wall means comprises a deformable wall which is partially defined by the shoulder of said compression ring.

8. The casing hanger of claim 5 wherein said deformable wall means comprises a wall which is formed in said slip bowl and is partially defined by the slip bowl shoulder.

9. The casing hanger of claim 5 wherein said deformable wall means comprises a deformable cylinder.

10. An improved casing hanger for suspending an inner pipe string or the like from the interior seat of a casing head comprising:

a slip bowl forming a ring having a central pipe string receiving bore therein and an exterior seat for engaging the interior seat of the casing head with a lower peripheral portion of said ring forming a shoulder;

a plurality of arcuate slip members disposed in circumferentially spaced relationship about said bore and forming an opening, said members being disposed for wedging movement downwardly and

inwardly into engagement with the exterior casing of a pipe string disposed in said opening to support the pipe string;

a compression ring having a shoulder disposed in spaced relationship with said slip bowl shoulder, said compression ring cooperating with said slip bowl so as to provide a limited degree of movement between said shoulders;

a sealing ring disposed between said shoulders and radially expandable to compressively sealingly engage the pipe string casing upon application of a compressive load between said shoulders; and

deformable wall means adjacent said sealing ring in generally concentric relationship therewith for deforming upon radial expansion of said seal ring to relieve the compressive force exerted by said sealing means when the compressive force exceeds a pre-established threshold level.

11. The casing hanger of claim 10 wherein said deformable wall means comprises a deformable cylinder.

12. The casing hanger of claim 10 wherein said deformable wall means is formed from metal.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,678,209

DATED : July 7, 1987

INVENTOR(S) : Walter L. Guice

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 3, line 8 (column 6, line 24) change "and" to --of--

Cancel claim 5 and substitute therefor the following:

Claim 5. An improved casing hanger for suspending an inner pipe string or the like from the interior seat of a casing head comprising:

a slip bowl forming a ring having a central pipe string receiving bore therein and an exterior seat for engaging the interior seat of a casing head with a lower peripheral portion of said ring forming a shoulder;

a plurality of arcuate slip members disposed in circumferentially spaced relationship about said bore and forming an opening, said members being disposed for wedging movement downwardly and inwardly with respect thereto into engagement with the exterior casing of a pipe string disposed in said opening to support the pipe string;

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,678,209
DATED : July 7, 1987
INVENTOR(S) : Walter L. Guice

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

a compression ring having a shoulder disposed in spaced relationship with said slip bowl shoulder, said compression ring cooperating with said slip bowl so as to provide a limited degree of movement between said shoulders;

sealing means disposed between said shoulders for compressively sealingly engaging the pipe string casing upon application of a compressive load between said shoulders; and

deformable wall means formed in at least one of said compression ring and said slip bowl members adjacent said sealing means for deforming to relieve the compressive force exerted by the sealing means when the compressive force exceeds a

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 4,678,209

DATED : July 7, 1987

INVENTOR(S) : Walter L. Guice

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

preestablished threshold level.

Signed and Sealed this

Twelfth Day of April, 1988

Attest:

Attesting Officer

DONALD J. QUIGG

Commissioner of Patents and Trademarks

US005971086A

United States Patent [19]

Bee et al.

[11] Patent Number: 5,971,086

[45] Date of Patent: Oct. 26, 1999

[54] **PIPE GRIPPING DIE**

[75] Inventors: **Robert M. Bee**; **William Ty Livingston**, both of Lafayette, La.

[73] Assignee: **Robert M. Bee**, Lafayette, La.

[21] Appl. No.: **08/912,220**

[22] Filed: **Aug. 15, 1997**

Related U.S. Application Data

[60] Provisional application No. 60/024,325, Aug. 19, 1996.

[51] **Int. Cl.**[6] **E21B 19/07**; E21B 19/10

[52] **U.S. Cl.** **175/423**; 166/75.14; 166/382; 188/67; 294/102.2; 294/902

[58] **Field of Search** 175/423; 166/382, 166/75.14, 243; 294/1.1, 102.1, 102.2, 902; 188/67

[56] **References Cited**

U.S. PATENT DOCUMENTS

2,010,938	8/1935	Abegg	175/423
2,493,556	1/1950	Stone	175/423
3,052,943	9/1962	Jones	188/67
4,475,607	10/1984	Haney	175/423
4,715,456	12/1987	Poe, Jr. et al.	175/423
5,451,084	9/1995	Jansch	294/1.1

Primary Examiner—Hoang C. Dang

Attorney, Agent, or Firm—Robert N. Montgomery

[57] **ABSTRACT**

A method for the construction of die members used in slips and elevators in the oil and gas industry for griping pipe. The die having nickel plated teeth with no mud grooves reduces die penetration thereby reducing stress cracking and carbon transfer in nickel alloy pipe thus reducing pipe corrosion.

12 Claims, 1 Drawing Sheet

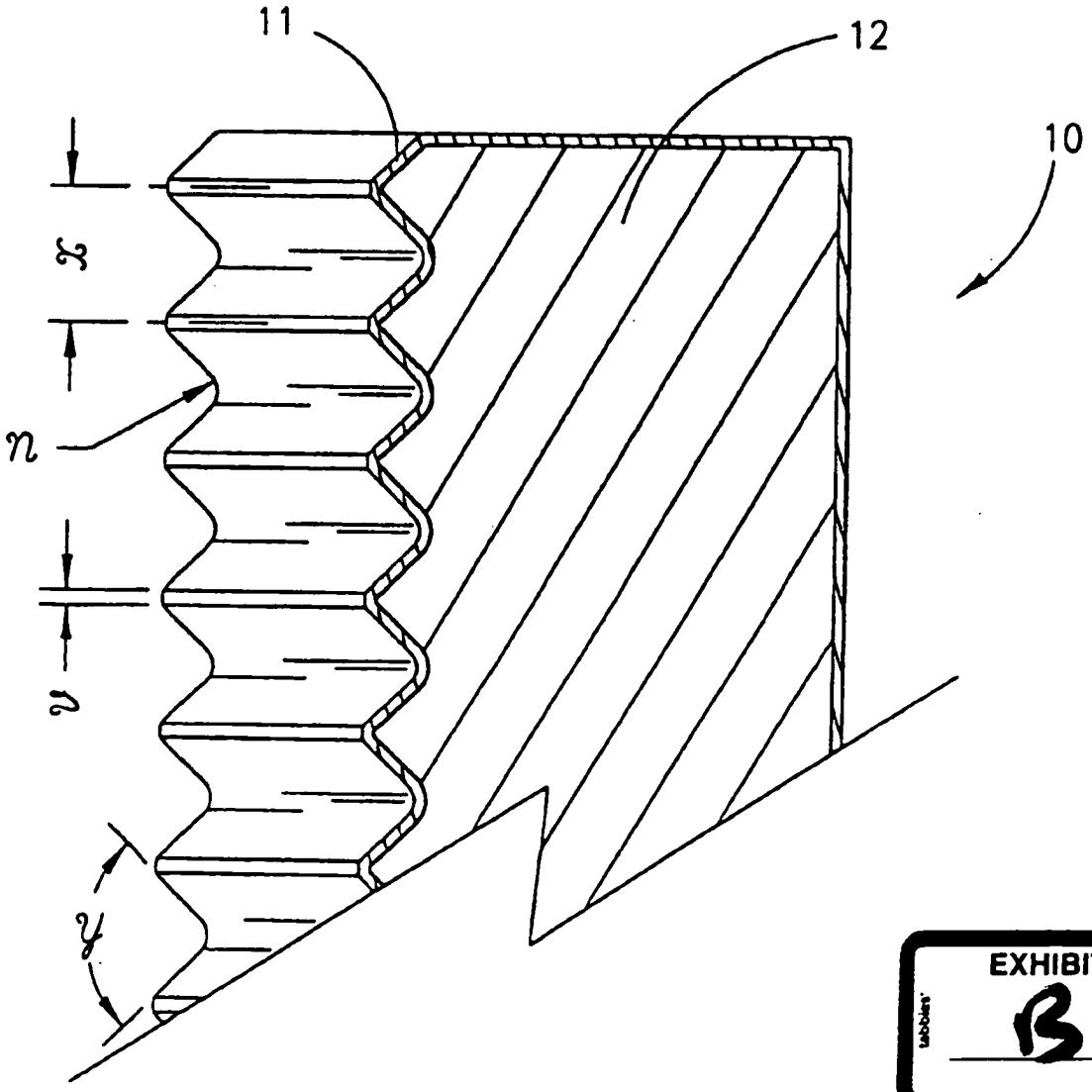

EXHIBIT B

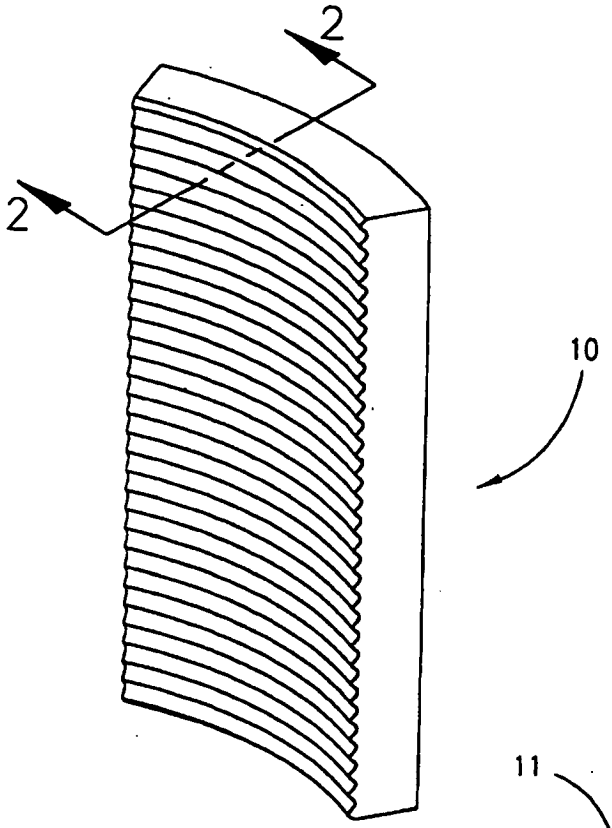

Fig. 1

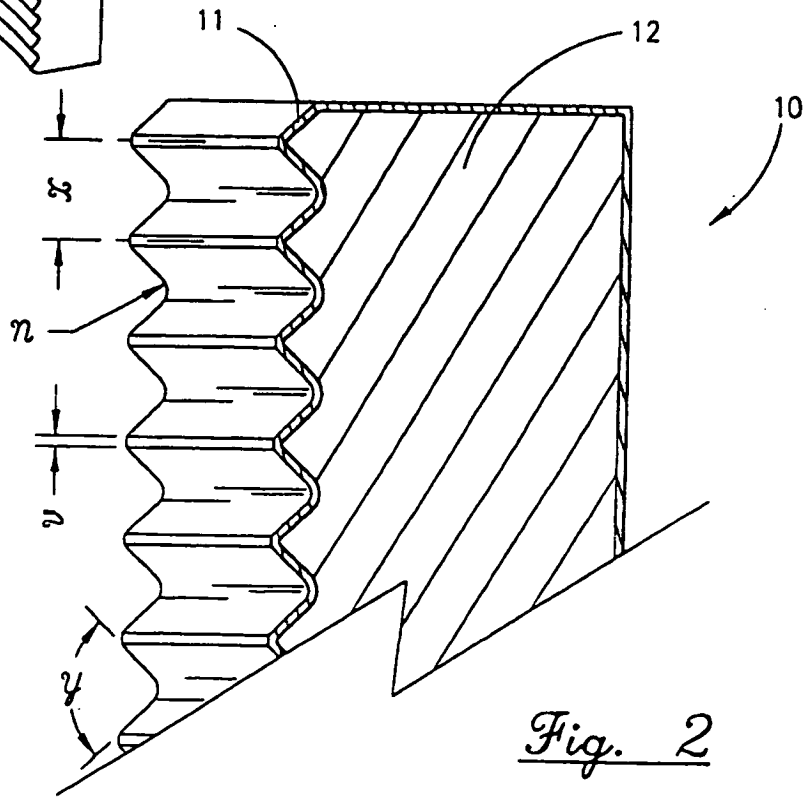

Fig. 2

PIPE GRIPPING DIE

This application claims benefit of U.S. provisional application 60/024,325 filed Aug. 19, 1996.

FIELD OF THE INVENTION

The present invention relates to pipe slips and elevators in general and more particular to the gripping dies used in such slips and elevators.

GENERAL BACKGROUND

Slips and elevators used primarily for lifting tubular goods, such as drill pipe or production tubing and the like, generally comprise a plurality of circumferentially spaced slip bodies called dies which are held collectively in a body which surrounds the locus of the drill pipe body and when used as slips the die body is in turn captured and held by a body known as a bowl. By means well known within the art, the device can be manipulated into position about the circumference of a length of pipe in a manner whereby the inner sides of the dies, having hardened metal gripping teeth, bite into and frictionally engaging the pipe body when the weight of the pipe is applied. The slip body retains the dies in place and allows the dies to have some degree of freedom with respect to the slip or elevator body, thereby allowing conformity with the pipe body. The dies are further contoured to generally conform to the curvature of the pipe body. Such slip and elevator dies are also available with various tooth configurations which help grip the pipe. Such configurations include mud grooves which allow the pipe dies to maintain a grip even in contaminated conditions, such as when the pipe is coated with mud and oil. However, it is well known in the art that damage to the pipe occurs when the dies wear unevenly or when the die teeth become damaged producing jagged edges, in which case stress risers may be set up in the surface of pipe which may result in premature pipe failure. The accepted method of gripping pipe in this manner depends on the ability of the die teeth to penetrate the surface of the pipe to some degree rather than apply excessive force which may crush or misshape the pipe.

The problem is compounded when such dies are used on high chromium pipe. Chromium or other nickel alloy pipe is often used in highly corrosive wells such as Hydrogen Sulfide (H_2s) gas wells. Such pipe is expensive and must be handled carefully to avoid damage to the chromium surface which attract corrosion, thereby leading to early failure. Therefore, a new and better means of handling such chromium and nickel alloy pipe is required in order to prevent damaging the chromium pipe surfaces. A problem also exists, when the hardened, high carbon, steel teeth on the dies make contact with the chromium or nickel alloyed pipe, thereby transferring small amounts of carbon to the pipe at each penetration point. Such carbon transfer spots have been found to set up sites for corrosion which lead to stress cracks in the pipe. It has been found that carbon creates galvanic action, thereby hardening pipe in the same manner as hydrogen sulfide, causing brittleness of the metal. Tests on chrome pipe with salt spray have shown that any discontinuity in the surface of the pipe causes a deterioration of between 0.011–0.015 loss in pipe wall thickness per year. For example, a number 13 chrome pipe having 0.217 wall thickness with a 0.028 penetration coupled with 0.015 corrosion factor per year accelerates corrosion deterioration exponentially.

Others in the art have attempted to address the problem of handling chromium pipe to and to reduce penetration, such as that disclosed by U.S. Pat. No. 5,451,084 wherein strips having hard teeth which get progressively softer along its length are held in a resilient base to allow flexibility. However such structures fail to address the problem of sharp tooth edges resulting from mud grooves cut vertically through the tooth configuration and the problem of carbon transfer to the pipe body.

Slip elevator and tong dies all rely on the biting action of the die's teeth into the pipe body for griping the pipe. However, recently the industry has begun addressing these problems by attempting to reduce stress induced into the surface of the pipe through better fits, flexible die seats, etc. However, to date, such dies still generally produce penetrations of between 0.017–0.028 of an inch with pipe loads of 14000 ft. with up to 100% carbon transfer. Test show that such high carbon deposits in the penetrations of pipe used in high corrosive wells last only a few weeks. In any case, the industry still considers die penetration of the surface of the pipe necessary. However, it is becoming essential that such penetration by the die teeth into the pipe body must be kept to a minimum, generally in the order of less than 0.002/1000 of an inch.

SUMMARY OF THE PRESENT INVENTION

The present invention addresses the issues raised by the above discussion. Since it has been established that pipe dies generally must penetrate the surface of the pipe in order to maintain a positive grip and thus avoid crushing the pipe, and it is essential that this penetration be kept to a minimum, the concept of the present invention is therefore to provide dies which have a minimum number of teeth corners or edges, which tend to break and/or dig into the pipe body, make minimum penetration and provide a hard, non-carbon coating over the die teeth which will prevent carbon transfer to chromium or other such nickel alloy pipe.

It is therefore an object of the invention to provide a pipe die having the ability to grip a pipe with a minimum penetration of less than 0.002/1000 of an inch without leaving carbon deposits in such penetrations.

It is still a further object of the invention to provide a pipe die having a minimum number of sharp edges which could cause cuts or otherwise mark the surface of a chromium or nickel alloy pipe body.

BRIEF DESCRIPTION OF THE DRAWINGS

For a further understanding of the nature and objects of the present invention, reference should be made to the following detailed description, taken in conjunction with the accompanying drawings, in which like parts are given like reference numerals, and wherein:

FIG. 1 is an isometric view of the present invention;

FIG. 2 is a partial cross section view taken along sight lines 2—2 in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As illustrated in FIG. 1, the present invention comprises a pipe die insert or segment 10 having a tooth profile as shown in FIG. 2. The die insert 10 usually one of several used cooperatively in pipe slips and elevators. The die insert, being generally configured in the same manner as that accepted as standard in the industry for such slips and elevators, comprises a die generally made from 8620 or 1018 steel 12, case hardened to a depth of 0.030 to 0.035 thousandths of an inch, and an optimum of eight teeth per

inch. Departing from such standard practice, the present invention provides a larger tooth radius illustrated in FIG. 2 by diameter dimension υ, shown at the tooth tips, larger tooth root radius η, no mud grooves and a special coating 11. The tooth profile is a 90 degree included angle Y, a tooth, tip radius of 0.030–35 thousandths of an inch, a tooth root radius η of 0.005 thousandths of an inch, and a center to center distance between the teeth X of 0.125 thousandths of an inch. The special coating 11 is a 0.0002 to 0.0007 thick coating of hard chrome or electroless nickel in solution, chemically disposed by ionic transfer, furnished by Gull Industries under the trade name of GULLITE-CHROMIUM™. This process provides a thin, very adherent, high quality, dense chromium deposit. The deposit is ideally suited to configurations such as threads and splines where conventional platings are not practical. The coating exhibits very high degree of hardness and withstands high temperatures. This coating has proven to achieve superior corrosion and wear characteristics when used in corrosive atmospheres. It has also exhibited excellent resistance against chipping, cracking or separation from the base material.

The larger tooth tip radius and the plating reduces the tooth penetration drastically. Tests have shown that up to 14000 ft of chromium pipe can be held successfully with the instant die **10** with virtually no pipe marking and only 0.0005/1000 penetration with 17000 ft . of pipe. Such test have also shown a loss of contact area on the dies of less than 5% after running 17000 ft of pipe and effecting a carbon transfer of only 1% of the contact surface area at 18,500 ft. of pipe. Therefore, a 0.0005/1000 penetration and carbon transfer rate 1% drastically reduces the rate of corrosion and possibility of stress cracking leading to pipe failure

Testing has also indicated that the handling of pipe die slips and elevators plays an important role in the degree of damage done to the surface of pipe. Workers tend to allow the slip tool bowl to close the slips which causes a great deal of slip scarring on the pipe. However, if the slips are handled correctly and closed completely before positioning in the slip bowl the present dies **10** leave little or no penetration and very little carbon transfer on the pipe surface. By eliminating mud grooves generally used on dies in the prior art, the present die **10** has fewer corners thereby reducing the number of stress points which may cause damage to the dies **10**. A further benefit has been found by using the present die **10**. After each pipe run the slip dies are often replaced and the dies returned to the manufacturer for inspection and replacement or refurbishing. A great deal of time is expended in sand blasting the dies prior to inspection. It has been found that the sand blasting process, which often hides surface stress cracks, is not necessary when the dies **10** are plated **11** and can be easily cleaned with solvent prior to inspection thus reducing labor and cost. Since the plating process **11** reduces the stress on the dies and the die suffers less damage due to a reduced number of corners the dies **10** consistently last longer, thereby further reducing cost.

The present invention therefore extends the art by proving that the need for deep penetration is not necessary and that carbon transfer can be prevented, thus increasing pipe life and reducing cost associated with slip and elevator dies.

Because many varying and different embodiments may be made within the scope of the inventive concept herein taught and because many modifications may be made in the embodiments herein detailed in accordance with the descriptive requirement of the law, it is to be understood that the details herein are to be interpreted as illustrative and not intended to limit the invention.

What is claimed is:

1. A pipe die insert of the type generally used with pipe slips and elevators in oil and gas drilling operations, the die comprising:

i) an elongated steel die member having a concave face relative a longitudinal axis;

ii) a plurality of arcuate, anticline teeth juxtaposed along said concave face and running transversely to said longitudinal axis; and

iii) a hard chrome plating applied to said teeth.

2. A pipe die according to claim **1** wherein said die comprises eight teeth per inch of said steel die member.

3. A pipe die according to claim **1** wherein said teeth are uninterrupted across said concave face.

4. A pipe die according to claim **1** wherein said hard chrome plating is an electroless nickel plating process having a thickness of between 0.0001 and 0.0004.

5. A pipe die according to claim **1** wherein said hard chrome plating is an electroless nickel plating process having an equivalent hardness in excess of 70 Rockwell "C".

6. A pipe die according to claim **1** wherein said hard chrome plating is an electroless nickel plating process having a high resistance to hydrogen sulfide.

7. A pipe die insert of the type generally use with pipe slips and elevators in oil and gas drilling operations, the die comprising:

a) an elongated steel die member having a concave face along a longitudinal axis;

b) a plurality of arcuate, anticline teeth juxtaposed along said concave face and running transversely to said longitudinal axis, said die member having eight teeth per linear inch of die member with said teeth having a 90 degree included root angle and a center to center tooth spacing of 0.125 on an inch; and

c) a hard chrome electroless plating applied to said teeth having a thickness of 0.0001–0.0002 of an inch with a hardness in excess of 70 Rockwell "C".

8. A method of retaining a string of nickel alloy drill pipe in a bore hole comprising the steps of:

a) replacing a compatible set of die inserts, in a slip-type gripping assembly commonly used for griping said string of nickel alloy drill pipe, with a replacement set of dies comprising:

i) an elongated steel die member having a concave face along a longitudinal axis;

ii) a plurality of arcuate, anticline teeth juxtaposed along said concave face and running transversely to said longitudinal axis, said die member having eight teeth per liner inch of die member with said teeth having a 90 degree included root angle and a center to center tooth spacing of 0.125 on an inch; and

iii) a hard chrome electroless plating applied to said teeth having a thickness of 0.0001–0.0002 of an inch with a hardness in excess of 70 Rockwell "C"; and

b) utilizing said griping assembly and said replacement set of dies to retain said string of nickel alloy drill pipe in a bore hole with a pipe die penetration of said drill pipe less than 0.002 thousandths of an inch.

9. The method according to claim **8** including the step of repetitiously engaging a suspended string of said nickel alloy pipe, up to 17000 feet in length, with said dies without transferring carbon from said dies to said pipe.

10. The method according to claim **8** includes the step of engaging a suspended string of said nickel alloy pipe with said dies produces a carbon transfer rate of between 1–2% of the contact surface between said dies and said pipe with a suspended pipe string of 18,500 feet in length.

11. A method for reducing cost of inspection and increasing useful longevity of pipe slip dies comprising the steps of;

a) providing an elongated steel pipe slip die member having a concave face relative its central longitudinal axis, said concave face having a plurality of arcuate, anticline teeth juxtaposed along said concave face and running transversely to said longitudinal axis; and

b) applying hard chrome plating to said pipe slip die member.

12. The method according to claim 11 further includes the step of deburring said pipe slip die member, leaving said pipe slip die member without any sharp edges.

* * * * *

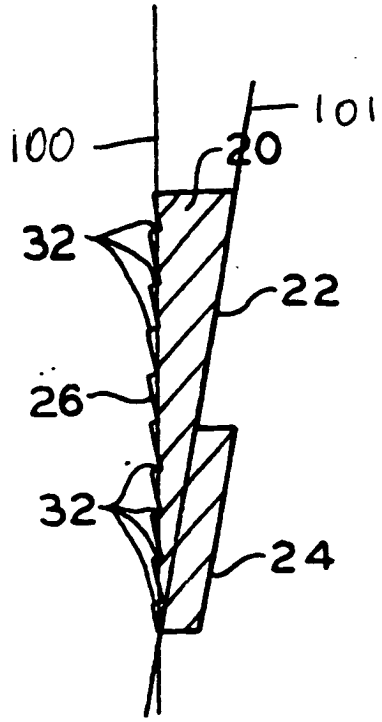

FIG. 3

Exhibit C
U.S. Patent No. 4,678,209

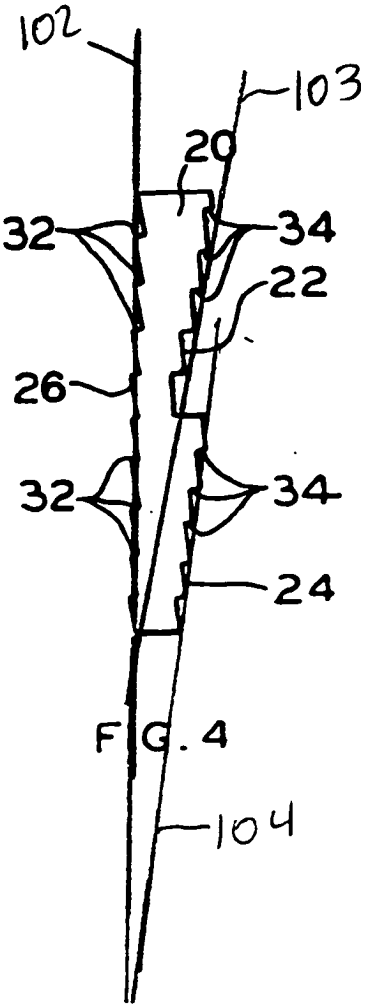

FIG. 4

EXHIBIT
C